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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/010,786 | 11/09/2001 | Vlad Novotny | 13441-002001/ | 5860 |

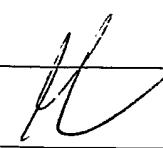
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| EXAMINER | |
| VALENCIA, DANIEL E | |
| ART UNIT | PAPER NUMBER |

2874

DATE MAILED: 12/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|------------------------|---|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/010,786 | NOVOTNY ET AL.  | |
| | Examiner | Art Unit | |
| | Daniel E Valencia | 2874 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on _____.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-34 is/are pending in the application.
 - 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) 32-34 is/are allowed.
- 6) Claim(s) 1-30 is/are rejected.
- 7) Claim(s) 31 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 04 April 2002 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 - a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ . |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1 . | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Inventorship

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-13, 20, 21, 25, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aksyuk U.S. Patent No. 6,173,105. Refer to the appropriate drawings or parts of the specification. Aksyuk discloses an article comprising a light actuated micromechanical photonic switch with ^{nearly} all the limitations of the abovementioned claims. Regarding claim 1, Aksyuk discloses a device (fig 1 and 4) comprising a first fiber (11) having a first facet end; a second fiber (12), parallel to said first fiber, having a second end facet which opposes said first end facet with a gap to directly receive light from said first end facet without coupling optics therebetween; and a blade (14) having a first blade surface facing said first end facet and forming an angle (col. 3, lines 5-15) with respect to said first end facet, said blade movably engaged to said substrate (fig 1) to move in and out of said gap at various positions to allow said blade to intercept a variable portion of the beam in said gap to adjust an amount of light directly coupled from said first fiber into said second fiber (col. 2, lines 5-20); and an actuator (fig 1) built on said substrate and engaged to said blade to adjust a position of said blade in said gap in response to a control signal. Aksyuk further discloses that the first blade surface is optically reflective (col. 2, lines 13-15), as mentioned in instant claim 3. Referring to claim 4, the actuator sets an initial position of said blade at which said blade does not intercept the beam in said gap (fig 1). Aksyuk disclosure shows that the facets of said first and second fibers are substantially perpendicular to optical axes of said first and said second fiber, which substantially coincide (fig 4), as explained in instant claim 6. With regards to claim 7, Aksyuk discloses that the facets of said first and second fibers are coated with antireflective film (col. 2, lines 1-2). Aksyuk further discloses that the end facets form an angle with respect to optical axes of said first and said second fibers, respectively, and wherein said first fiber is spatially shifted from said second fiber to allow a

maximum coupling efficiency from said first fiber to said second fiber when the blade does not intercept the light (see col. 1, line60-col. 2, line15), as described in instant claim 8. Aksyuk's disclosure also shows that the blade has a second blade surface facing said second fiber, said second blade surface being substantially perpendicular to said optical axis of the second fiber (fig 4), as mentioned in instant claim 9. Referring to claim 10, Aksyuk also discloses that the surface of the blade can form an angle with respect to said optical axis. Aksyuk's disclosure depicts the first blade surface being substantially perpendicular to the second blade surface, as described by instant claim 11. Regarding claim 12, Aksyuk discloses that the actuator is a rotational actuator, the device further comprising an arm having one end engaged to said actuator and an opposite end engaged to said blade, said arm amplifying a motion of said actuator to be a greater motion of said blade (col. 3 and fig 1). Aksyuk discloses that the device further comprises an optical coupler to split a fraction of light received by said second fiber from said second end facet to produce a monitor beam; an optical detector to receive said monitor beam to produce a detector output; a feedback circuit coupled to said optical detector and said actuator to control a position of said blade to control an amount of light received by said second fiber in response to said detector output (fig 3 and col. 5, lines 1-20), as described by instant claims 13 and 27. With reference to claim 20, Aksyuk discloses that the feedback circuit produces a bias signal to said actuator to set said actuator to a bias position at which said blade does not obstruct the light from being coupled from said first fiber to said second fiber (col. 3, lines 45-50). Although Aksyuk does not explicitly state that his device can set the blade at an initial position in between the fibers as mentioned in claims 5 and 21, this would be an obvious variation from an initial position outside the gap. Aksyuk teaches that the position depends on the voltage applied. It

would follow that one could set an initial position based on the bias voltage applied to the actuator, depending on the application. Regarding part of claim 25, Aksyuk discloses that the gap allows for direct optical coupling between said two fibers without coupling optics with a low insertion loss. It would be implicit that the loss be less than 1 dB (col. 2, lines 1-6), as mentioned in the claim. Aksyuk however; does not disclose that the fibers are fixed to the substrate. Although the reference fails to explicitly state that the fibers are fixed to the substrate, it is well known in the art to fix optical fibers to a substrate for alignment with each other or with an optical device. In addition, although Aksyuk does not explicitly call the attenuator a blade, the “shutter” in the reference has the same physical properties and serves the same purposes as a blade would. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to fix the fibers to a substrate in the device disclosed by Aksyuk.

Claims 2, 14, 16-19, 22, 26, and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aksyuk in view of O’Keefe U.S. Patent No. 6,246,826. Refer to the appropriate drawings or parts of the specification. Aksyuk discloses an optical attenuator with a majority of the limitations of the present invention including the gap widths mentioned in instant claims 29 and 30 (col. 4, lines 45-55); however, the reference fails to mention that the blade or shutter of the attenuator can be made of transparent material or the use of a comb driven actuator for moving the blade.

On the other hand, O’Keefe discloses a variable optical attenuator with a profiled blade that teaches the limitations that the Aksyuk reference lacks. Regarding claim 2, O’Keefe discloses that the blade used in the optical attenuator can be transparent (col. 6, lines 45-55).

O'Keefe discloses that the attenuator's actuator is an electrostatic rotational comb device with a first set of stationary conductive teeth and a movable part with a first set of movable conductive teeth, said movable part movably engaged to said stationary part to have positions at which said movable teeth spatially interleave (see fig 2b) with said stationary conductive teeth to electrostatically (col. 4) interact to control movement of said movable part in response to a control voltage applied between said stationary conductive teeth and said movable teeth, as explained in instant claims 14, 26, and part of 28. With reference to claims 16, 17, and 18, O'Keefe teaches that his device can be used with actuators utilizing electromagnetic gears, thermal expansion, or movable piezo-electric elements. O'Keefe further discloses that the actuator is biased at a position at which movement of the actuator is approximately linear with respect to a change in a control to said actuator (col. 3, lines 1-15), as mentioned in instant claim 19. Regarding claims 22 and 26, O'Keefe discloses that the actuator can be biased at a position at which movement of the actuator is damped with respect to a change in said control signal to said actuator (col. 4, lines 34-36). O'Keefe discloses a similar device that moves a blade in between two fiber end facets for intercepting some of the light. O'Keefe teaches that it is advantageous to use a comb driven actuator to drive the blade, because the actuator is based on capacitance and provides no continuous power dissipation (col. 5, lines 30-40). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the comb driven actuator disclosed in O'Keefe in the device disclosed by Aksyuk.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aksyuk and O'Keefe in view of Zhang U.S. Patent Application No. 2002/0172452 A1. Refer to the

appropriate drawings or parts of the specification. Aksyuk and O'Keefe as applied above, disclose an optical device for positioning a blade in between two fibers for varying the amount of light intercepted by the blade, wherein the blade is moved by a comb driven actuator on a substrate; however, the references do not teach the use of two comb driven actuators.

On the other hand, Zhang discloses a latching apparatus for a MEMS optical switch that teaches the limitation that the combination of Aksyuk and O'Keefe lacks. Regarding claim 15, Zhang discloses an actuator including a second set of movable conductive teeth, wherein the stationary teeth and the movable part interleave each with one another at said positions (fig 1, 144 and 146). Zhang teaches that it is advantageous to use two comb driven actuators for stability when moving the blade along a substrate. In addition, since Zhang, Aksyuk, and O'Keefe all disclose optical devices including a blade movable along a substrate by an actuator; therefore the references would all be combinable. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use two comb driven actuators in the device disclosed by Aksyuk and O'Keefe.

Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aksyuk '105 in view of Aksyuk U.S. Patent No. 6,075,239. Refer to the appropriate drawings or parts of the specification. Aksyuk as applied above discloses an optical attenuator with a majority of the limitations of the present invention; however, the reference fails to teach the use of serpentine hinges.

On the other hand, Aksyuk '239 discloses and article comprising a light actuated micromechanical photonic switch used as an attenuating device that teaches the limitation that that Aksyuk '105 lacks. Regarding claims 23 and 24, Aksyuk '239 discloses a device with a movable blade for attenuating light in between optical fibers, wherein the actuator that drives the blade linearly includes two serpentine torsional hinges (fig 2 and fig 3). Both references disclose devices including a blade for insertion between fiber facets for attenuating light therebetween. Aksyuk '239 teaches that it is advantageous to use torsional serpentine hinges, because it allows the beam holding the blade to pivot (col. 6, lines 24-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use torsional serpentine hinges, shown in Aksyuk '239, in the device disclosed by Aksyuk '105.

Allowable Subject Matter

Claim 31 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: As to dependent claim 31, the prior art alone or in combination does not disclose or render obvious a device required by independent claim 28, wherein said substrate includes a groove in which said first and said second fibers are located, said groove having a protruded feature at a location of said gap and with a length along said groove to be equal to desired spacing of said gap, and wherein said first and said second fibers are placed on opposite sides of protruded feature to have said first end facet and said second end facet positioned to contact protruded feature. For

example, Aksyuk U.S. Patent No. 6,075,239 discloses a MEMS switching/attenuating device with a majority of the claimed limitations including two fibers facing each other in a groove with a blade disposed in between both facets; however, the reference fails to teach the use of a protruded feature disposed in the gap in contact with both end facets.

Claims 32-34 are allowed.

The following is an examiner's statement of reasons for allowance: As to independent claim 32, the prior alone or in combination fails to disclose or render obvious a method comprising: causing a layer of selected material to be formed over a substrate surface; causing said layer to be processed to form a first pattern that selectively exposes and covers said substrate surface; causing exposed areas on said substrate surface to be etched to a first depth; causing a second substrate to be bonded to said patterned layer over said substrate surface; causing said second substrate to be thinned to a desired thickness to form a thin layer; causing a second layer of said selected material to be formed over a second substrate surface of said second substrate that is opposite to said surface bonded to said patterned layer; causing said second layer to be processed to form a second pattern that selectively exposes and covers said second substrate surface, wherein selectively covered areas include a first group and a second group; causing a photoresist mask layer to be formed over said second layer in only said first group to leave said second layer in said second group exposed; causing exposed areas on said second substrate surface to be etched to a first depth without penetrating said thin layer to form first etched exposed areas; causing said exposed second layer in said second group that is not covered by said photoresist mask layer to be removed by a dielectric etching processing without etching

exposed areas on said second substrate surface; causing etching of exposed areas on said second substrate surface including said first etched exposed areas and areas of said second group that are above said first etched exposed areas on said second substrate surface; causing said etching to be stopped when said first etched exposed areas are etched through to make exposed areas in said second group thinner than said area in said first group; and causing said second layer covering said first group to be removed. For example, Behin U.S. Patent Application No. 2002/0005976 A1 teaches a multi-layer combdrive electrostatic actuator and fabrication method, but does not explicitly or implicitly disclose all the necessary steps to meet the claim.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The prior art documents submitted by the applicant in the Information Disclosure Statement filed on November 9, 2001, have all been considered and made of record (note attached copy of form PTO-1449).

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Aksyuk U.S. Patent No. 5,923,798 discloses a micro machined optical switch that teaches the use of a blade movable in between two fiber end facets.

O'Keefe U.S. Patent Application No. 2001/0033731 A1 discloses a variable optical attenuator with profiled blade that teaches the use of a comb-driven actuator.

Dhuler U.S. Patent No. 6,275,320 discloses a MEMS variable optical attenuator using a blade disposed in between fiber ends for attenuation.

Dhuler U.S. Patent No. 6,410,361 discloses methods of fabricating in-plane MEMS thermal actuators that teaches the use of two substrates bonded together with patterns thereon created by photolithography.

Horsley U.S. Patent No. 6,465,355 discloses a method of fabricating suspended microstructures including two substrates one bonded to the other.

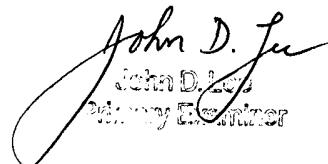
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel E Valencia whose telephone number is (703)-305-4399. The examiner can normally be reached on Monday-Friday 9:30-6:00.

The fax phone numbers for the organization where this application or proceeding is assigned are (703)-308-7724 for regular communications and (703)-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)-308-0956.

DV

Dan Valencia
December 13, 2002


John D. Lee
January Examiner